



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3164106**

**Semester – VI**

**Subject Name: Hydraulics and Pneumatics**

**Type of course:** Professional Elective Course

**Prerequisite:** None

**Rationale:** Hydraulics and Pneumatics is fundamental course for robotics and Automation engineers to understand Hydraulics and Pneumatics principle, Electro Pneumatic Systems. This course is essential for application of fluid power in process, construction and manufacturing Industries.

## Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

## Content:

Sr. No.	Content	Total Hrs
1	<b>FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS:</b> Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal’s Law – Principles of flow - Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps –Problems. .	8
2	<b>Direct And Inverse Kinematics:</b> Hydraulic Actuators: Cylinders Types and construction, Application, Hydraulic cushioning Hydraulic motors Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves Applications Accessories : Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols Problems.	9
3	<b>Hydraulic circuits and systems:</b> Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.	9



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<b>4</b>	<b>Pneumatic And Electro Pneumatic Systems:</b> Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.	<b>8</b>
<b>5</b>	<b>Trouble Shooting And Applications:</b> Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.	<b>7</b>

### Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>20%</b>	<b>25%</b>	<b>20%</b>	<b>26%</b>	<b>8%</b>	-

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference Books:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill.
3. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982
4. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995.
5. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.

**Course Outcomes:** After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain the Fluid power and operation of different types of pumps.	20%
CO-2	Summarize the features and functions of Hydraulic motors, actuators and Flow control valves.	20%
CO-3	Explain the different types of Hydraulic circuits and systems.	20%
CO-4	Explain the working of different pneumatic circuits and systems.	15%
CO-5	Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.	25%



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## **List of Experiments:**

Experiments similar to following list may be carried out.

1. Introduction to basic elements used in hydraulic circuits
2. Introduction to basic elements used in pneumatic circuits
3. Speed control with pneumatic vales
4. Speed control with hydraulic valves
5. To and fro motion control circuit with single acting / double acting cylinder and valves
6. Electro hydraulic circuits
7. Electro pneumatic circuits

## **List of Equipments:**

Related hydraulic and pneumatic valves and test set up are needed.

## **List of Open Source Software/learning website:**

- Autosim Premium
- Hydrosym